

TABLE I
OPERATIONAL DISPLAY UNIT
VERIFIATION MATRIX

REQUIREMENT	PARA	FIRST ARTICLE VERIFICATION METHOD				PRODUCTION TEST	
		ANALYSIS	DEMO	INSPECT	TEST		
Scope	1.0						
Ref. Docs.	2.0						
Item Def.	3.1		X				
Elec. Comp	3.2			X	X		X
Controls	3.3.1.1				X		X
Bandwidth	3.3.1.2				X		X
Resolution	3.3.1.3				X		X
Linearty	3.3.1.4				X		X
Retrace Time	3.3.1.5				X		
Prime Power	3.3.1.6				X		X
Display Tube	3.3.1.7			X			
Interface	3.3.1.8		X				
Serial Coupling	3.3.1.8.1		X	X	X		X
Brightness	3.3.1.9				X		X
Flicker & Jitter	3.3.1.10				X		X
DC Restoration	3.3.1.11				X		
Dynamic Focus	3.3.1.12				X		X
Interlace	3.3.1.13				X		X
Spot Size	3.3.1.14				X		X
Mounting	3.3.2.1			X			
Size & Weight	3.3.2.2				X		
Sunshield	3.3.2.5		X				
Reliability	3.3.3	X					
Part Control	3.3.3.1	X					
Maintainability	3.3.4	X					
Maint. Design	3.3.4.1				X		
Bench Repair	3.3.4.2	X		X			
Availability	3.3.4.3	X					
Operating Environ	3.3.5.1				X		
Non-Oper. Environ	3.3.5.2				X		
Elec. Transients	3.3.5.3.1				X		
Trans. Protection	3.3.5.3.2	X					
Surge Protection	3.3.5.3.3				X		
Power Comsumption	3.3.5.3.4				X		
Grounding	3.3.5.3.5			X			
P.S. Protection	3.3.5.3.6				X		
Load Protection	3.3.5.3.7				X		
P.S. Indicator	3.3.5.3.8				X		
P.S. Metering	3.3.5.3.9				X		

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3.2.6.1 Relays

In addition to the requirements of FAA-G-2100, relays utilized in the system (excluding contactors) shall meet the following requirement. A circuit diagram shall be provided on each relay. All chassis-mounted relays shall be of the plug-in type. The number of different relay types used shall be held to an absolute minimum. Each DC relay coil shall have a suitable damping diode or other device to eliminate transients.

3.3 CHARACTERISTICS

3.3.1 Performance Characteristics

3.3.1.1 Display Controls

Front panel controls shall be provided for power (on/off), brightness and contrast. Cover protected front panel maintenance controls shall be provided for horizontal and vertical raster size, and focus.

3.3.1.2 Video Bandwidth

The amplitude frequency response measured at the grid (or cathode) of the CRT shall be flat within 2dB (total variation) from 10KHz to 45 MHz and 3db (total variation) from 45MHz to 50MHz.

3.3.1.3 Resolution

The resolution shall be 1024 horizontal pixels by 1024 vertical pixels.

3.3.1.4 Linearity

No point on the raster shall deviate from its proper position by more than 1% of raster height.

3.3.1.5 Horizontal Retrace Time

Horizontal retrace time shall be 4 microseconds maximum.

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3.3.1.6 Prime Power

The operational display shall operate from a prime power source of 120 volts $\pm 15\%$, 60 Hz $\pm 5\%$, single phase.

3.3.1.7 Display Tube

The nominal operational display shall utilize a 17 inch (diagonal face) rectangular cathode ray tube having an aspect ratio of 4:3, and viewable screen dimensions of 7.7 inches by 10.3 inches for the 14 inch display, 9.2 inches by 12.2 inches for the 17 inch display and 10.5 inches by 14 inches for the 19 inch display.

Alternate phosphors may be offered provided they offer superior performance in the Air Traffic Control Tower environment; however, requires prior Norden approval before implementation. The cathode ray tube shall have implosion protection such that, following a crt implosion, glass fragments shall not be detected 12 inches beyond the crt faceplate.

3.3.1.8 Display Signal Interface

The operational display shall provide an input receiver to obtain sufficient common-mode rejection to voltage differentials between the scan converter and the display. The display unit shall meet the following requirements:

Video Input Waveform:	1 volt peak-to-peak nominal, negative going synch
Input Impedance:	75 ohms(per para.3.3.1.8.1
Video Polarity:	black negative
Signal-to-Noise Ratio:	33 dB or greater
Sweep Loss Protection:	the display CRT shall be protected from damage in case of loss of either vertical or horizontal sweep

3.3.1.8.1 Serial Coupling

The display shall provide serial coupling capability to allow serial connection of the video signal to three displays. The display shall provide two connections, one for the input video signal and the second for coupling the video signal to another display. Both connectors shall be a type "N" connector (reference MIL-C-39012) and shall be capable of mating with M39012.

The display shall also be supplied with a 75 OHM, type "N" connector termination (reference MIL-D-39030) and attached to the display by a chain.

The performance characteristics of any display shall not deteriorate below those specified in section 3.3 when two or three displays are serial coupled together.

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Synchronization: the horizontal scan rate shall be 36,750 Hz (1,225 line rate) and the pulse duration timing scaled from EIA-STD-RS-343, Figure 1. Line rate sensing and switching shall be automatic

Gray Scale Reproduction: 10 shades of gray (minimum) with 10 uniformly spaced video levels

Input Timing Input timing shall be in accordance with Figure 2 of this specification

3.3.1.9 Brightness

The display shall provide operator adjustable controls in accordance with paragraph 3.3.1.1 to produce minimum contrast ratios as specified in the following table, measured with 11-bar by 11-bar grating pattern with each grating bar 0.25 inch (.64cm) side, and the horizontal and vertical sweep adjusted for a full useful diameter picture. The brightness of the intensified grating bars shall not vary more than 20 percent over the useful diameter picture. All measurements shall be made through the spectral faceplate filter using a Spectra Spot Brightness Meter (Model 1960) or equivalent.

Contrast Ratio
6:1

Room Ambient Light
1000 ft. candles

3.3.1.10 Flicker and Jitter

There shall be no flicker discernable to the operator under the conditions specified in paragraph 3.3.1.9. The display jitter shall be less than 0.0005 of the display diameter.

3.3.1.11 DC Restoration

100 percent dc restoration shall be provided.

3.3.1.12 Dynamic Focus

Dynamic focus shall maintain overall display focus. Line width shall not vary by more than 1.4 to 1 over the full raster area. A maintenance adjustment shall adjust the amplitude of the dynamic focus modulation.

3.3.1.13 Static Focus

Provisions shall be made for adjusting static focus from the exterior of the unit without removing the cover.

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3.3.1.14 Interlace

The display shall maintain 2:1 interlace. The minimum acceptable interlace factor shall be more than 0.6 (where $0.6 = 70/30$) over the entire picture area, and at one setting of the monitor hold control. Definition: Interlace is the positioning of the scan lines of alternate fields so that the even field lines are vertically spaced between the odd field lines. Perfect interlace is obtained when all lines are equally spaced vertically. The degree of interlace is defined as the Interlace Factor (IF). The Interlace Factor (IF) is defined as,

$$IF = 2D1/d1 + D2$$

where D1 and D2 are spaces or the distance between adjacent scanning lines measured in arbitrary units and D1 is taken to be the smallest of the two. Interlace Factor (IF) will then vary between unity, for perfect interlace and zero for no interlace.

3.3.1.15 Spot Size

The spot size shall be 10 mils +2 mils for the 14 inch display, 13 mils +2 mils for the 17 inch display and 16 mils + 2 mils for the 19 inch display.

3.3.2 Physical Characteristics

3.3.2.1 Mounting

The display unit shall be capable of being mounted in each of the following ways:

- a) Desk-top, Fixed
Four nylon skids shall be located on the four corners of the display bottom to allow the unit to sit on desk-top or counter-top.
- b) Desk-Top, Swivel
A detachable trunnion bracket that can be mounted to the display via one hole in each side of the unit with the saddle and swivel at the display bottom. The bracket shall mount to a 1-inch pipe flange that can be screwed to the table-top and the trunnion assembly connected to the flange via a 1-inch pipe close nipple. When mounted in this position, it shall be possible to position the display +150 minimum + 180 maximum in azimuth and +45 minimum/+60 maximum degrees in elevation. The trunnion bracket shall be designed so that both azimuth and elevation rotation of the display may be locked by hand-operated locking devices. Also, these locking devices shall retain the display in whatever position it is placed without the necessity of locking.
- c) Ceiling Mount, Swivel
The trunnion assembly shall be so designed that it can be attached to the display as in (b), except the saddle and swivel shall be at the display top and a one-inch (nominal) pipe flange attached to the ceiling. When top-mounted, the trunnion assembly shall operate the same as in (b).

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